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The genus *Dysdera* is remarkable among spider genera in showing a wide range of variation in body size and mouthpart size and shape. The genus has been traditionally considered a specialised predator on woodlice, but recent studies have revealed the existence of different levels of prey specialisation among the species. *Dysdera* has undergone a remarkable diversification in the Canary Islands, where more than 50 endemic species have been recorded. It has been hypothesized that trophic segregation among co-occurring species was a major driver of morphological diversification in Canarian *Dysdera* and hence that prey specialisation might lie behind its outstanding richness of species. In the present study we test prey specialization and resource partitioning in several species of Canarian *Dysdera* by combining prey preference experiments, with nutritional adaptation and molecular prey detection methods. We took advantage of DNA-based methods, which offer the ability to identify prey where prey hard parts do not survive the digestion process, as is the case for spiders and other terrestrial invertebrates. Specifically, we used a metabarcoding approach to characterize dietary preferences in the wild in several co-occurring species of Canarian *Dysdera*. Our preliminary experimental results showed that cheliceral morphology is a predictor of the level of prey specialisation. Additionally, species with different cheliceral types also showed differential use and assimilation of nutrients. Those findings reveal the relationship between morphology, prey preference and food specialization, which may ultimately lead to the generation of biodiversity.